

Patent Application
Docket No. UF-206X
Serial No. 09/172,689

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner : Susan B. McCormick
Art Unit : 1661
Applicants : Eric B. Bish, Daniel Cantliffe, Craig Chandler
Serial No. : 09/172,689
Filed : October 14, 1998
For : Strawberry Transplant Conditioning For Flower Induction

Assistant Commissioner for Patents
Washington, D.C. 20231

DECLARATION OF DANIEL J. CANTLIFFE, Ph.D., UNDER 37 C.F.R. § 1.132

Sir:

I, Daniel J. Cantliffe, Ph.D., of the University of Florida, hereby declare:

THAT, I am an inventor on the above-referenced patent application;

THAT, I have received the following degrees:

B.S.	Horticulture Delaware Valley College	1965
M.S.	Horticulture Purdue University	1967
Ph.D.	Plant Physiology Purdue University	1971

THAT, I have been employed professionally as follows:

1992 - present	Professor and Chair	Horticultural Sci. Dept.	University of Florida
1991 - 1992	Professor/Act. Chair	Fruit Crops Dept.	University of Florida
1988 - 1991	Coordinator	Graduate Program	University of Florida
1985 - 1992	Professor/Chair	Vegetable Crops Dept.	University of Florida
1984 - 1985	Professor/Act. Chair	Vegetable Crops Dept.	University of Florida

1983 - 1984	Professor/Asst Chair	Vegetable Crops Dept.	University of Florida
1981 - present	Professor	Vegetable Crops Dept.	University of Florida
1979 - 1980	Visiting Professor	Dept. of Horticulture	University Hawaii
1976 - 1981	Associate Professor	Vegetable Crops Dept.	University of Florida
1974 - 1976	Assistant Professor	Vegetable Crops Dept.	University of Florida
1970 - 1974	Research Scientist	Horticulture Research Inst.	Simcoe, Ontario, Canada
1969 - 1970	Research Associate	Dept. of Vegetable Crops	Cornell University, NYSAES
1965 - 1969	Research Assistant	Dept. of Horticulture	Purdue University

THAT, I have been an active member of the following professional and scholarly organizations:

1998 - 2002	Chair, Section of Vegetables, International Society for Horticultural Science
1996 - present	Elected, Florida Agricultural Conference and Trade Show (FACTS) Board
1995 - 1996	Chairman of the Board
1994 - 1995	President
1993 - 1994	President Elect, American Society for Horticultural Science
1992 - 1993	Chairman Executive Committee
1991 - 1992	President, Florida State Horticultural Society
1991 - 1992	Vice President Research Division, American Society for Horticultural Science
1990 - 2002	Council Member, International Society for Horticultural Science
1987	Vice President Vegetable Section, Florida State Horticultural Society

THAT, I have authored several publications, including 145 refereed articles, 182 non-refereed articles, 226 miscellaneous articles, and 14 book chapters. Some of these publications that pertain specifically to strawberry production are:

1. Al-Dlaigan, Y.I., D.J. Cantliffe and H.J. Klee. Protocols for gene transformation in strawberry (*Fragaria ananassa* cv. Sweet Charlie). Intl. Assoc. Plant Tissue Culture and Biotech. 2002. Orlando, FL. p. 121A.

2. Bish, E.B., D.J. Cantliffe, and C.K. Chandler. Temperature conditioning and container size affect early season fruit yield of strawberry plug plants in a winter annual hill production system. *HortScience* 2002. Vol. 37 p. 762-764.
3. Darnell, D.L., D.J. Cantliffe, D.S. Kirschbaum, and C.K. Chandler. The physiology of flowering in strawberry. *Horticultural Reviews*. Vol. 26. J. Janick, ed. 2002.
4. Paranjpe, A., D.J. Cantliffe, E.M. Lamb, P.J. Stoffella and C. Powell. Increasing winter strawberry production in North-Central Florida using passive ventilated greenhouses and high plant densities. XXVIth Intl. Hortic. Congress and Exhibition. 2002. Toronto, Canada. p. 392.
5. Al-Dlaigan, Y.I. and D.J. Cantliffe. Direct shoot organogenesis and gene transformation in strawberry (*Fragaria x ananassa* cv. Sweet Charlie). *HortScience* 2001. Vol. 36 p. 559.
6. Bish, E.B., D.J. Cantliffe, and C.K. Chandler. A system for producing large quantities of greenhouse grown strawberry plantlets for plug production. *HortTechnology* 2001. Vol. 11 p. 636-638.
7. Hochmuth, G.J., C. Chandler, C. Stanley, D. Legard, J. Duval, E. Waldo, D.J. Cantliffe, T. Crocker, and E. Bish. Containerized transplants for establishing strawberry crops in Florida. *HortScience* 2001. Vol. 36 p. 443.
8. Paranjpe, A., D.J. Cantliffe, E.M. Lamb, P.J. Stoffella, and C. Powell. Strawberries grown in soilless substrate under greenhouse conditions can increase winter production in North-central Florida. *HortScience* 2001. Vol. 36 p. 442.
9. Bish, E. B., D. J. Cantliffe, and C. K. Chandler. Strawberry daughter plant size alters transplant growth and development. *Acta Horticulturae*. 2000. Vol. 533. pp. 121-126.

10. Kirschbaum, D., D.J. Cantliffe, C.K. Chandler, and R.L. Darnell. Initiation of flowering, runner formation, and carbohydrate distribution in strawberry (*Fragaria x ananassa* Duch.) mother and daughter plants grown at different temperatures. *HortScience* 2000. Vol. 35, pp. 504.
11. Kirschbaum, D.S., J. Honorato, D.J. Cantliffe. Strawberry waiting bed plants: a valid alternative to increase early and total yields in sub-tropical regions. *Scientia Horticulturae*. 2000. Vol 82. p. 83-90.
12. Kirschbaum, D. S., D. J. Cantliffe, R. L. Darnell, and E. B. Bish. Propagation site latitude influences initial carbohydrate concentration and partitioning growth and fruiting of 'Sweet Charlie' strawberry (*Fragaria x ananassa* Duch.) transplants grown in Florida. *Florida State Hort. Soc. Proc.* 1998. Vol. 111, pp. 93-96.
13. Kirschbaum, D. S., J. Honorato, and D. J. Cantliffe. Strawberry waiting-bed plants: a valid alternative to increase early and total yields in subtropical regions. *HortScience*. 1998. Vol. 33, pp. 459.
14. Bish, E. B., D. J. Cantliffe, G. J. Hochmuth and C. K. Chandler. Development of containerized strawberry transplants for Florida's winter production system. *Acta Horticulturae*. 1997. Vol. 439 I, pp. 461-468.
15. Bish, E. B. and D. J. Cantliffe. Development of a strawberry plug transplant system. In: The Fifth National Symposium on Stand Establishment. The Ohio State University. M. A. Bennett and J. A. Metzger eds. 1997. pp. 225-230.
16. Bish, E. B. and D. J. Cantliffe. Container size and bulk density alter growth of strawberry transplants. *Proc. Fla. State Hort. Soc.* 1997. Vol. 110, pp. 258-261.

17. Bish, E. B., D. J. Cantliffe, and C. K. Chandler. Strawberry Fields Forever in Florida? *Citrus & Vegetable Magazine*. Vol. 60. 1996. pp. 38-44.
18. Bish, E. B., D. J. Cantliffe, and C. K. Chandler. Strawberry plug transplants: Regulation of growth and production. *Proc. Fla. State Hort. Soc.* 1996. Vol. 109:160-164.
19. Bish, E. B., D. J. Cantliffe, and C. K. Chandler. Pretransplant temperature regime and container size alter strawberry plant morphology. 1996. *HortScience*. Vol. 31. pp. 566.

THAT, through my years of research, I have kept up to date on the technical literature and maintained contact with experts in the field by participating in professional meetings and seminars, and by direct personal contact. As a result, I am familiar with the general level of skill of those working in the field of horticulture;

THAT, I have read and understood the specification and claims of the subject application and the Office Actions dated June 5, 2001; March 12, 2002; and November 1, 2002;

AND, being thus duly qualified, do further declare:

There are significant distinctions that must be appreciated between our invention and the work described in Heide's publication (*Physiologia Plantarum*, Volume 40 pp 21-26: 1977). Our invention is directed to a method for controlling flower induction in strawberry plants in a controlled-temperature environment by growing the strawberry plants for a first growing period of at least six weeks at a daytime temperature reaching at least 30°, and abruptly reducing the daytime temperature during a second growing period, after the first growing period, to about 25°C.

The work by Heide related to the effect of photoperiod and temperature on growth and flowering of strawberry cultivars. Heide used several cultivars of strawberries, including at least five cultivars that were induced to flower under short photoperiods. Heide conducted several experiments

interacting four photoperiods (10, 12, 14, and 16 hours of light) and three temperatures (12°C, 18°C, and 24°C) on plants that were previously grown in a soil mix in a greenhouse under continuous light for 24°C for about three weeks. Heide indicates that three-week old plants were subjected to five-week treatments at the various temperature and day lengths as previously indicated. In these experiments, the treatment temperatures, 12°C, 18°C, and 24°C, were constant day/night temperatures. Heide did not alternate temperature during any of these experiments. The results of Heide's experiments were certainly not surprising, as they simply showed that short photoperiods (10 or 12 hours) led to flowering in the cultivars used, and that if the temperatures were a constant 12° or 18°C for five weeks, Heide was able to induce a larger amount of flowers on the plants at 10-hour or 12-hour photoperiods compared to those plants grown at a constant 24°C, as evident in Figures 1 and 2 at page 22 of the Heide publication.

Claim 18 of our patent application states that the daytime temperature of the strawberry plant is reduced to enhance the induction of flowering in the strawberry plant. Our patent application indicates that flowering is induced by reducing the daytime temperature abruptly after a period of growing the plants at high temperature, *i.e.*, above 30°C for periods of at least 6 weeks. Then, and most importantly, the daytime temperature is to be reduced, abruptly, to about 25°C. In Heide's work, temperatures for floral induction were best when maintained at constant temperatures of 12°-18°C under short photoperiods, *i.e.* constant 12 hours or less. In contrast, using the method of our invention, by growing plants for an extended period (at least 6 weeks) under high temperature and then abruptly lowering the temperature to about 25°C, we induce flowering regardless of photoperiod. Furthermore, as stated in our patent application, this happens regardless of nighttime temperature. Again, in the Heide work, nighttime temperature has to be 12 or 18°C in order to achieve a flowering response from only the shortest of photoperiods (10-12 hours). As recited in claims 23-25, the nighttime temperature may be maintained at 30 degrees or higher, or the nighttime temperature may also be reduced. Our invention exploits the fact that neither photoperiod nor nighttime temperature are critical—only the abrupt change of temperature from 30°C to a temperature of about 25°C in order to induce flowering in strawberry plants. The experiments

conducted by Heide at constant day/night temperatures do not teach or suggest this fact, or our invention.

In a book chapter by George Darrow ("The Strawberry," Chapter 20, Holt, Rinehart and Winston, pages 355-365, 1966), it is reported that long photoperiods and cool nights are considered favorable for flowering in strawberry cultivars that are field grown. Darrow also reports that it was the nighttime temperature that was most important to induce flowering, not the daytime temperature, which is recited in claim 18 of our patent application. As evident at pages 361-363, the recurring theme in the Darrow publication is that proper photoperiod and low temperatures generally induce flowering in the three strawberry types discussed. Once again, our invention exploits the fact that, regardless of photoperiod and night temperature, the most significant factor to induce flowering of a strawberry plant is to abruptly reduce the daytime temperature from 30°C or higher to about 25°C. The Heide and Darrow publications, when considered alone or taken together, do not teach or suggest our invention as claimed.

The undersigned declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or of any patent issuing thereon.

Further declarant sayeth naught.

Signed:

Daniel J. Cantliffe
Daniel J. Cantliffe, Ph.D.

Date:

March 27, 2003